

**COCKPIT RESOURCE MANAGEMENT:
A TOOL FOR IMPROVED FLIGHT SAFETY
(United Airlines CRM Training)**

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The number one goal of everyone in the field of aviation has always been safety. Throughout the industry, whenever appropriations are sought or budgets are submitted, the avowed purpose of the request is to achieve greater performance or efficiency. The underlying premise, however, is that safety be enhanced. The welcome result of this process has been an ever-improving safety record.

The most dramatic breakthrough in increasing aircraft reliability was the development of the jet engine. Advanced technology and redundancy of systems have also led to improved reliability; therefore, most accidents are no longer due to a failure of the aircraft or its equipment. Another positive factor was the development of advanced flight simulators. This resulted in almost total elimination of accidents in the training environment, while at the same time, training on the more demanding emergency procedures was enhanced.

In spite of these advancements, however, the safety statistics are leveling off and today we find little improvement in accident prevention. The part of the puzzle that has escaped solution to date is how to prevent the human errors that are now a cause of most accidents. In the period from 1970 to 1980 statistics reflected that in 60% of all fatal commercial air carrier accidents the causal factor, or one of the causal factors, was poor management of the resources available to the cockpit. If all of the fatal accidents in the aviation industry (including corporate, military, and general aviation) are analyzed for that same period, we find that 80% had as a causal factor poor management of the cockpit resources. Therefore, it is not surprising that an increasing number of recommendations made by the National Transportation Safety Board address this issue. These recommendations have emphasized the need to assure better management of the resources available to the cockpit and the need for more effective communication of vital information among the crewmembers.

Recognizing the cause of an accident is one thing, but preventing a similar accident from occurring in the future can be quite difficult. In addition, indicating that poor management of the resources available to the cockpit was the cause for the accident can be, to a crewmember, another way of saying, "It was pilot error." In the past, listing the cause of an accident as "pilot error" usually meant there was a lack of acceptable performance in the area of psychomotor skills or technical training. Therefore, an indication of pilot error as the reason for an accident is a sensitive issue with pilots and

¹ The CRM Company is a joint venture of Scientific Methods, Inc. and United Airlines, Inc.

organizations.

One of the principal reasons that effective cockpit resource management is necessary is because aviation operates in an imperfect human environment. Recognizing this, many in the industry have avoided attacking the problem in the belief that it was too delicate an issue, too ambiguous, or one that might even defy solution. It is, however, too important an issue to be avoided any longer.

Any program developed to address this last piece of the aviation safety puzzle must be one that is not looked upon as being a threat to the pilot's sense of security or one that could be viewed as something to cover the legal responsibilities of the company or the government. The best chance for success is if the program is recognized as one that enhances the professionalism of any already highly professional and skilled group.

Research efforts into the problem include the work done by KLM with their KHUFAC program. Also, NASA has been extremely instrumental with their research on LOFT and the impact of external influences on crew performance. The military has been addressing the impact of human factors, and IATA, IFALPA, and others have held numerous conferences and forums on the topic of CRM since 1975.

Success, however, in any phase of aviation training, is dependent not only on the best equipment, procedures, and techniques but on proven methods and continuous training throughout an individual's career. Highly developed and integrated training programs are successful when, in times of stress, crews react as they have been trained to do and when that training becomes part of their standard operating procedure. Therefore, if improvement is to be made in the human factors area, any training given must be of high quality, accepted by the population, and repeated often enough that it becomes an accepted ingredient in the day-to-day operation.

With this background, United Airlines in 1979 embarked upon an ambitious plan to develop a fully integrated approach to the problem. After many months of investigation and study United entered into a collaborative arrangement with Scientific Methods, Inc. to create a multi-faceted and all-encompassing training program--one that would lead to improved problem solving and also create an atmosphere of openness within its cockpits that would ensure a more efficient and safe operation.

It was first agreed that there could be no "quick-fix" to the cockpit management problem and that achieving results would not simply be a matter of gathering pilots into a room and providing a stand-up lecture on the importance of open communication nor by presenting a theory of leadership behavior. There was also agreement that effective change in teamwork skills would not be realized simply by reviewing case studies of accidents and teaching tips and techniques on improved communication.

Therefore, the two central issues that were to be addressed in determining how to best implement effective resource management training were: 1) the content of what was to be learned, and 2) the learning methodology to gain the needed behavioral changes.

There is significant data that indicate a sound, theory-based approach to the cockpit management problem can pay real dividends in improved safety through better

teamwork performance. The challenge was to provide a method or system so that, based on that theory, comparative learning for what is effective and what is not could take place. Using such a methodology, crewmembers would have a hands-on opportunity to experiment with and compare different forms of resource management. Each crewmember could then develop and crystallize his thinking as to what effective teamwork in the cockpit really means.

The Grid theory utilized by Scientific Methods was chosen as the basis for providing the understanding of teamwork dynamics. Five elements were then identified as being important in a comparative system of learning cockpit management. These are inquiry, advocacy, conflict resolution, critique, and decision making. They provide a framework and a set of standards for assessing the consequences from relying on anything but the most effective behavior. This allows anticipation and vigilance to replace complacency and assumption on the flight deck.

The Cockpit Grid uses a specially prepared text written for crewmembers. This is read as part of a home study program and is "Phase 1" of the CRM training. The use of a framework for understanding teamwork dynamics also provides a common "language" for use in applying the succeeding phases of the program.

The second phase involves a structured learning process that allows crewmembers to learn, firsthand, how to use their newly-acquired intellectual knowledge for informed understanding of behavioral effectiveness. Crewmembers are able to analyze how they react to various leadership styles in the cockpit and how their own behavior can affect operational outcomes. This phase of the training is conducted in a seminar environment, allowing the crewmembers to address this new area without the burden of the detailed attention normally necessary in the operation of a cockpit.

In the seminar, learning occurs as a result of crewmembers working in a crew concept with others and learning to be effective in using the various elements listed above to achieve teamwork. Thus, one of the important concepts in the applied theory approach is that learning comes about from the structured experience contained in the training itself as opposed to listening to a trainer, psychologist, or other kind of expert lecturing from the front of a training classroom.

The issue of personality frequently arises when resource management training is discussed and the interrelationship of attitudes, behavior, and personality is frequently focused upon. Our approach has been to concentrate on those areas of human factors where we know change can occur. These areas are principally crewmember attitudes and behavior. Personality is one area which Cockpit Resource Management training does not try to impact.

Before participants attend a CRM Seminar, crewmembers fill out several scales and questionnaires which assess their attitudes about effective cockpit behavior. Even before training, crewmembers have positions on what they believe are the most effective and ineffective styles. Statistics show that the most effective style is valued by crewmembers about 75% out of what is possible at the beginning of the program, whereas at the end of the training program, this measure increases to 88% of the maximum value possible. This is a clear indication that cockpit attitudes about effective and ineffective behavior

have been strengthened and crystallized.

Another important issue involves how crews see their own actual behavior in the cockpit. This encompasses the issue of self-deception. Unless pilots and other crewmembers can be aware that they may come across to other crewmembers in a way that is less than effective, there is probably not much motivation for behavior change since the operating assumption by these crewmembers is that they are already as effective as possible.

Statistics show that on average, 84% of the participants who will undergo Cockpit Resource Management training believe that their operating style is about as effective as possible. At the end of the training, this percentage drops to less than 30%. This indicates that considerable progress has been made toward stripping away self-deception. The import of this in the areas of both attitudes and behavior is that at the end of the training, attitudes about effective cockpit behavior have been strengthened, while at the same time, a better picture is developed for how each crewmember actually operates in the cockpit itself. When all crewmembers have received the training and a stronger set of cultural standards have been put in place, then critique and feedback can be used to strengthen behavior of others and ensure that higher quality standards stay in place.

Although individual personalities may not have been changed, a stronger set of cultural standards can create a cockpit climate and environment where the "unsafe personality" will no longer be tolerated. Other crewmembers actively use the CRM elements of inquiry, advocacy, conflict resolution, critique, and decision making in order to deal with the "less than effective" behavior of another crewmember.

Another focus of this theory-based approach is centered around the concept of synergy itself. The importance of synergy for aviation safety is based on the notion that two or three or more crewmembers working together in a sound way can come up with a more effective solution to the problem at hand than one person acting alone, or three working at cross-purposes and canceling one another out.

The concept of synergy is important for crewmembers to study especially in the context of the use of effective command structure and hierarchy in the cockpit. Synergy and its achievement through effective teamwork in the cockpit enhances the captain's command and strengthens his or her control of the cockpit instead of diminishing it. The important factor here is that the captain is open to input from others and the crew itself is jointly committed to contributing to the best possible solution. This basis of crew interaction provides the maximum likelihood that the technical competencies of each crewmember as well as the resources from all sources, human and material, will be utilized.

An important element in achieving synergy is the use of critique and feedback in order to optimize teamwork and cockpit behavior. The NTSB has noted that the use of planning and effective critique prior to a B-727 departure in Denver may have been significant in preventing a serious accident when the crew encountered windshear at the point of rotation. The NTSB commented that the cockpit resource management training used to develop the critique and teamwork skills for this crew may have been instrumental in contributing to its effective problem solving.

"The Safety Board believes that United's cockpit resource management training may have played a positive role in preventing a more serious accident from occurring in Denver and that it is an endeavor that should be encouraged. The Board previously has recognized the benefits of this training when it recommended in 1979, as the result of several accident investigations, in which the breakdown in cockpit resource management was identified as a contributing factor, that the FAA:

"Urge . . . operators to ensure that their flightcrews are indoctrinated in principles of flight deck resource management, with particular emphasis on the merits of participative management for captains and assertiveness training for other cockpit crewmembers. (A-79-47)"

The self-study program and seminar make an indispensable contribution to better teamwork, but they can only be a part of the training if there is to be the hoped-for application in the flight environment. They do, however, provide a very strong foundation upon which to build for future operational effectiveness.

Having provided the opportunity for attaining an intellectual understanding of team dynamics, plus the opportunity to apply this understanding in a seminar environment, United has made Cockpit Resource Management a part of its recurrent training program for all cockpit crewmembers.

The initial part of the recurrent training provides a refresher on the theory and principles involved in good cockpit resource management.

A line-oriented flight training (LOFT) exercise is then conducted in the flight simulator where all crewmembers have an opportunity, in their own crew position and in a familiar environment, to practice the principles previously instilled. Two flights are flown by each crew and recorded on videotape. At the conclusion of the exercise, the videotape is reviewed by the crew, solely for the training value that can be achieved. This review is conducted as a peer discussion among the crewmembers with no critique from an instructor or check airman. The purpose of the discussion is to highlight the parts of the flight that were performed well and also those that perhaps could have been accomplished in a more efficient manner. In the first case, positive reinforcement takes place and, in the second, learning for application at the next opportunity. Subsequent to the review by the crew, the tape is erased and no record kept of the items reviewed on the tape. This fosters the recognition among crewmembers that the approach is one of enhancing their professional abilities. As a result, the response of the crews to the training is very positive.

Due to the success of the Cockpit Resource Management training program, United has applied the principles to other areas of the flight crewmembers' training and supervision.

CRM leadership concepts have been incorporated into the training that crewmembers receive when they upgrade from one cockpit crew position to another. In addition, these concepts have been made an integral part of both the enroute checks that are given annually and the initial operating experience subsequent to an upgrading

exercise. The broad application has given United a fully integrated approach to Cockpit Resource Management. A United crewmember may therefore expect, from the day that he or she is hired, to find that the concepts of Cockpit Resource Management are an integral part of every facet of their experience as a crewmember.

This fully integrated approach to Cockpit Resource Management provides education in theory, practice in applying the theory, an opportunity in a recurrent training environment to critique individual and crew performance and it creates an atmosphere that encourages providing feedback to ensure better practices in the future.

A key to the success of the program is the mutual respect and confidence among crewmembers that is created, which fosters an environment that is conducive to openness, candor, and constructive critique. The result is a more professional performance due to the synergy that is achieved in the cockpit.

In summary, our theory-based approach and the methodology used in developing cockpit management skills is effective because of the following features:

- 1) A comparative method of learning is used enabling crewmembers to study different forms of teamwork.
- 2) The learning comes about as a result of crewmembers learning from one another instead of from an "expert" instructor.
- 3) Key elements of cockpit teamwork and effective management are studied so that crewmembers can determine how these elements can improve safety and problem solving.
- 4) Critique among the crewmembers themselves rather than from outsiders is used as a common focusing point for crews to provide feedback to one another on how each can be a more effective crewmember.
- 5) The training is continuous in the sense that it becomes part of recurrent, upgrade, and other forms of crewmember training and development.
- 6) The training results in sound and genuine insights that come about through solid education as opposed to tutoring, coaching, or telling crewmembers how to behave more effectively.

In response to requests from others in the industry, United Airlines and Scientific Methods, Inc. have, since September, 1982, been providing this training via their joint venture, "Cockpit Resource Management." Over 1000 cockpit crewmembers have attended these seminars and the response has been universally positive. Participating organizations include domestic and international airlines, corporate operators, government regulators, and the armed forces.

In addition, given the attention that is being directed to the need for improved Cockpit Resource Management, several large air carriers, with our assistance, have instituted a resource management training program for their own flight crews. There

have also been jointly-sponsored seminars in different parts of the world to introduce this training, and branches of the armed forces in both the U. S. and Canada are engaged in the planning process to build CRM training into their training requirements. When this is added to the large number of corporations that have committed to send all their pilots through the training, it is clear that the overall aviation community recognizes the utility and need for this contribution to aviation safety.